Docket No. 50353 (70329)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT:	Pandya et al.	
SERIAL NO.:	09/228,694	GROUP: 1752
FILED:	January 12, 1999	EXAMINER: S. Lee
FOR:	HYDROXYLPHENYL COPOLYMERS AND PHOTORESISTS COMPRISING SAME	

THE HONORABLE COMMISSIONER OF PATENTS AND TRADEMARKS
WASHINGTON, DC 20231

SIR:

APPEAL BRIEF

Applicant respectfully appeals the decision of the Examiner, dated March 29, 2001, finally rejecting claims 1-34.

This corrected appeal brief is being filed in triplicate. The requisite fee for filing this brief was submitted on April 1, 2002.

I. REAL PARTY IN INTEREST

The real party in interest in this appeal is Shipley Company, L.L.C., the assignee of the application.

II. RELATED APPEALS AND INTERFERENCES

To the knowledge of the undersigned, there are no current appeals or interferences that will directly affect, or be directly affected by, or have a bearing on the Board's decision in this appeal.

III. STATUS OF CLAIMS

Claims 1-34 have been presented in this application.

Claims 1-34 are presently on appeal (see the attached Appendix).

IV. STATUS OF AMENDMENTS (AFTER FINAL REJECTION)

No amendments have been filed since the mailing of the final rejection on March 29, 2001.

V. SUMMARY OF THE INVENTION

Brief Background of Technical Field.

Photoresists are photosensitive films for transfer of images to a substrate. After coating a photoresist on a substrate, the coating is exposed through a patterned photomask to a source of activating energy to form a latent image in the photoresist coating. A relief image is provided by development of the latent image pattern in the resist coating. See the application at page 1.

For high performance applications, such as manufacturing of microelectronic wafers, the need exists for new photoresists that can provide highly resolved images of submicron dimension. See page 2 of the application.

Summary of Appellant's Invention

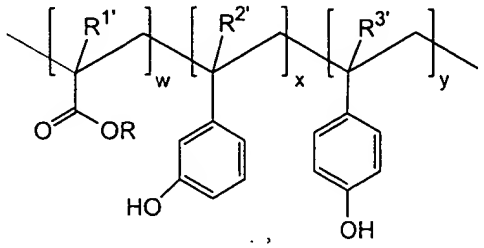
Appellant has discovered photoresists that contain copolymers that comprise: at least one repeating unit that is a meta-hydroxyphenyl derivative; at least one repeating unit that is a para-hydroxyphenyl derivative; and one or more photoacid labile groups. See page 2, last paragraph of the application.

Appellant's independent claims 1 and 24 are representative of the subject matter on appeal and read as follows:

> Claim 1. A photoresist composition comprising a photoactive component and a resin that comprises a polymer that comprises 1) an acid labile group; 2) a meta-hydroxyphenyl group; and 3) a para-hydroxyphenyl group, wherein the meta-hydroxyphenyl group has a single meta-hydroxy moiety and is unsubstituted at other available ring positions.

> Claim 24. A photoresist composition comprising a photoactive component and a resin that comprises a polymer that comprises 1) an acrylate acid labile group; 2) a meta-hydroxyphenyl group; and 3) a para-hydroxyphenyl group.

Preferred polymers of the invention have repeating units that have a single moiety on the metahydroxy-phenyl group. See page 4, lines 1-4; and page 5, last two lines of the application. Acrylates are preferred acid labile groups, such as tert-butyl acrylate. Particularly preferred photoresists of the invention contain a polymer that comprises a structure of the following Formula IV:



IV

Appellant discovered that addition of a meta-hydroxyphenyl unit to a polymer containing para-hydroxyphenyl units and acid-labile units can quite favorably impact dissolution rates and solubility differentials between exposed and unexposed regions of a resist coating layer that contain the polymer. See page 3, first paragraph of the application.

Such properties exhibited by photoresists of the invention can enable formation of highly resolved resist images. Resists of the invention that have too high of a dissolution rate can exhibit relatively decreased resolution when printing sub-micron features. See the application at page 3, first paragraph.

Such results also are demonstrated by the data set forth in the **Rule 132 Declaration of Dr. Pandya**. That Declaration is of record, with a further copy attached.

Dr. Pandya's Declaration details significantly reduced dissolution rates provided by polymers of the invention that include meta-hydroxyphenyl units, relative to comparable polymers that do not include meta-hydroxyphenyl units. As mentioned, such reduced dissolution rates can provide significantly enhanced lithographic performance of a photoresist that contains the polymer. See page 3, first paragraph of the application.

VI. ISSUES

1. Whether claims 1-34 are unpatentable under 35 U.S.C. §103 over Watanabe et al. (U.S. Patent 5,844,057).

2. Whether claims 1-34 are unpatentable under 35 U.S.C. §103 over Urano et al. (EP 0 780 732 A2).

3. Whether claims 17-18 are unpatentable under 35 U.S.C. §102(b) over Watanabe et al. (JPO abstract: JP406049137A and Derwent abstract: 1994-097835 – English language abstract of JP406049137A).

4. Whether claims 1, 3, 5 and 13-16 are unpatentable under 35 U.S.C. §103 over Watanabe et al. (JPO abstract: JP406049137A and Derwent abstract: 1994-09735 – English language abstract of JP 406049137A) in view of Watanabe et al. (U.S. Patent 5,844,057).

5. Whether claims 23, 27 and 29 are unpatentable under 35 U.S.C. §112, second paragraph.

VII. GROUPING OF THE CLAIMS

The rejected claims do **not** stand or fall together since each claim is considered separately patentable in its own right.

Appellant believes that all of the claims under appeal are separately patentable for the reasons set forth in the argument section which follows.

VIII. ARGUMENT

A. THE ISSUES ON APPEAL.

ISSUE 1: Whether claims 1-34 are unpatentable under 35 U.S.C. §103 over Watanabe et al. (U.S. Patent 5,844,057).

Appellant respectfully submits that the cited document simply fails to teach or suggest the claimed invention.

Among other things, the Watanabe document (U.S. Patent 5,844,057) reports polymers that have *multiple* ring substitution. See columns 23 through 30 of U.S. Patent 5,844,057.

In contrast, Appellant's independent claim 1 specifically recites a *meta-hydroxyphenyl group which has a single meta-hydroxy moiety and is unsubstituted at other available ring positions*.

Nor does the Watanabe document suggest polymers that contain an acrylate acid labile group as recited in Appellant's independent claim 24. Rather, the Watanabe document reports linking acid labile onto phenolic groups.

See also Section 2143.03 of the Manual of Patent Examining Procedure: "To establish *prima facie* obviousness, all the claim limitations must be taught or suggested by the prior art."

As discussed above, that MPEP mandate is contravened by the instant rejections. None of the documents disclose a meta-hydroxyphenyl group that has a single meta-hydroxy moiety and is unsubstituted at other available ring positions, or that further comprises an acrylate unit, as Appellant claims.

ISSUE 2: Whether claims 1-34 are unpatentable under 35 U.S.C. §103 over Urano et al. (EP 0 780 732 A2).

Appellant respectfully submits that the cited document fails to teach or suggest the claimed invention.

Indeed, the Urano document is even less pertinent than the Watanabe citation.

Urano merely provides a general report of phenolic polymers. The examples in the Urano document do not include a polymer having meta-substitution.

In contrast, for example, Appellant's independent claim 1 recites a *meta-hydroxyphenyl group which has a single meta-hydroxy moiety and is unsubstituted at other available ring positions*.

ISSUE 3: Whether claims 17-18 are unpatentable under 35 U.S.C. §102(b) over Watanabe et al. (JPO abstract: JP406049137A and Derwent abstract: 1994-097835 – English language abstract of JP406049137A).

Appellant again respectfully submits that the cited document simply fails to teach or suggest the claimed invention.

For example, Watanabe et al. JP406049137A does not teach or suggest polymers having meta-hydroxyphenyl groups as Appellant claims.

In contrast, Appellant's independent claim 1 specifically recites a *meta-hydroxyphenyl group which has a single meta-hydroxy moiety and is unsubstituted at other available ring positions*.

Further, as stated above, the Watanabe document does not teach or suggest polymers that contain an acrylate acid labile group as recited in Appellant's independent claim 24. Rather, the Watanabe document reports linking acid labile onto phenolic groups.

In view thereof, the §102 rejection is improper. See, for instance, *In re Marshall*, 198 USPQ at 346 ("[r]ejections under 35 USC 102 are proper only when the claimed subject matter is identically disclosed or described in the prior art.").

ISSUE 4: Whether claims 1, 3, 5 and 13-16 are unpatentable under 35 U.S.C. §103 over Watanabe et al. (JPO abstract: JP406049137A and Derwent abstract: 1994-09735 – English language abstract of JP 406049137A) in view of Watanabe et al. (U.S. Patent 5,844,057).

Appellant respectfully submits that the cited documents, even in combination, fail to teach or suggest the claimed invention.

As stated above, Watanabe et al. JP406049137A does not teach or suggest polymers having meta-hydroxyphenyl groups as Appellant claims.

Further, the Watanabe document (U.S. Patent 5,844,057) reports polymers that have *multiple* ring substitution. See columns 23 through 30 of U.S. Patent 5,844,057.

Indeed, even the final Office Action appears to acknowledge that Watanabe et al. JP406049137A is even further removed from Watanabe U.S. Patent 5,844,057. See page 11 of the Office Action.

ISSUE 5: Whether claims 23, 27 and 29 are unpatentable under 35 U.S.C. §112, second paragraph.

With regards to the Section 112, second paragraph rejection pertaining to matters of form, Appellant is agreeable to amending the pertinent claims to obviate the rejection.

For example, it is acknowledged that claim 23 recites a limitation "z" which should be deleted. Further, claims 27 and 29 contain informalities requiring clarification and will be suitably amended to obviate the rejection. In particular, these claims should properly recite --90 mole percent--, rather than --90 percent-- of total units of the polymer.

B. COMPARATIVE EXPERIMENTAL DATA OF RECORD FULLY REBUTS ANY *PRIMA FACIE* CASE UNDER SECTION 103 THAT MAY BE CONTENDED TO EXIST.

Relative to the issues on appeal set forth above, while Appellant fully believes that a *prima facie* case under Section 103 has not been presented by the cited documents, it also is believed that the comparative data set forth in the application as filed fully rebuts any *prima facie* case that may be contended to exist.

In this regard, attention is directed to the **Rule 132 Declaration of Dr. Pandya**, of record and copy attached, which demonstrates significant performance differences upon use of a meta-hydroxyphenyl unit in combination with a para-hydroxyphenyl unit as Appellant claims. Such results are clearly not suggested by any of the cited documents.

In the final Office Action, that Declaration is disregarded on grounds that the polymer of Watanabe was not tested. See page 14 of the final Office Action.

That position does not withstand scrutiny. That is, contrary to the position advanced in the final Office Action, a Declaration **cannot** be disregarded merely because additional tests would be desired by the Office. All evidence **must be** considered, particularly in this case, where the evidence of record directly supports patentability. See, for instance, Section 716.01(a)

of the Manual of Patent Examining Procedure, which states in part (emphasis added):

> Affidavits or declaration containing evidence of criticality or unexpected results .... **must be** considered by the examiner in determining the issue of obviousness of claims for patentability under 35 U.S.C. 103.

In addition to those arguments presented above, and further in view of the results presented in Rule 132 Declaration of Dr. Pandya, it is respectfully submitted that the rejection of claims under §103 is simply improper.

C. EACH OF THE CLAIMS ON APPEAL IS SEPARATELY PATENTABLE.

The documents cited in the rejections on appeal also provide no suggestion of other claimed aspects of Appellant's invention.

Independent claim 1 recites the following:

> Claim 1. Ä photoresist composition comprising a photoactive component and a resin that comprises a polymer that comprises 1) an acid labile group; 2) a meta-hydroxyphenyl group; and 3) a para-hydroxyphenyl group, wherein the meta-hydroxyphenyl group has a single meta-hydroxy moiety and is unsubstituted at other available ring positions.

As discussed above, the prior art documents, whether considered alone or in combination, simply fail to teach or suggest the photoresist composition of claim 1.

It also is respectfully submitted that dependent claim 2 is separately patentable because the cited documents do not teach or suggest a photoresist of claim 1, with the further limitation that the polymer comprises pendant acrylate acid labile groups.

Claim 3 is separately patentable for the above-stated reasons and further because the cited documents fail to teach or suggest the photoresist or polymer of claim 1 where the polymer has a structure represented by the specified Formula I. Clearly none of the cited documents suggest that recited formula. Dr. Pandya's Declaration also demonstrates significant performance results with such polymers.

Claims 4 and 5 depend from claim 3, and are likewise separately patentable for the aforementioned reasons, and further in view of their respective additional limitations. For example, claim 4 limits substituent W to comprise an acrylate ester. Claim 5 limits the sum of x, y and z to at least about 90 mole percent of total units of the polymer.

Claim 6 is separately patentable for the above-stated reasons and further because the cited documents fail to teach or suggest the photoresist of that claim where the polymer has a structure represented by the specified Formula II. Clearly none of the cited documents suggest that recited formula. Dr. Pandya's Declaration also demonstrates significant performance results with such polymers.

Claims 7 and 21 each depend from claim 6, and further limit the subject matter of claim 6. In particular, claim 7 limits the sum of w, x and y to at least about 90 mole percent of total units of the polymer. Claim 21 limits substituent R to a tert-butyl group, adamantyl, tetrahydropyranal, or norbornyl group. As such, claims 7 and 21 are each separately patentable not only for the aforementioned reasons, but also further in view of the additional limitations recited therein.

Claim 8 is separately patentable for the above-stated reasons and further because the cited documents fail to teach or suggest the photoresist of that claim where the polymer has a structure represented by the specified Formula III. Clearly none of the cited documents suggest that recited formula.

Indeed, Formula III calls for tetrapolymers. Much greater structural similarity has been required to sustain a *prima facie* case under Section 103. See, for instance, *In re Grabiak*, 226 USPQ 870 (Section 103 rejection reversed on basis that *prima facie* obviousness did not exist in view of structural differences between claimed subject matter (thioester) and prior art (ester)). Dr. Pandya's Declaration also demonstrates significant performance results with such polymers.

Claim 9 depends from claim 8, and merely limits the sum of w', x', y' and z' to at least about 90 mole percent of total units of the polymer. As such, claim 9 is separately patentable not only for the aforementioned reasons, but also further in view of the additional limitation.

Claim 10 is separately patentable for the above-stated reasons and further because the cited references fail to teach or suggest the photoresist of that claim where the polymer comprises a structure represented by the specified Formula IV. Clearly none of the cited documents suggest that recited formula. Dr. Pandya's Declaration also demonstrates significant performance results with polymers having a structure of Formula IV.

Claims 11 and 12 depend from claim 10, and each provides a further limitation to the subject matter of claim 10. For example, claim 11 limits substituent R to a tert-butyl group, adamantyl, tetrahydropyranal, or norbornyl group. Claim 12 limits the sum of w, x and y to at least about 90 mole percent of total units of the polymer. As such, claims 11 and 12 are each separately patentable not only for the aforementioned reasons, but also further in view of the noted limitations.

Independent claim 13 recites the following:

Claim 13. A method for forming a photoresist relief image, comprising:
a) applying a layer of a photoresist composition of claim 1 on a substrate; and
b) exposing and developing the photoresist layer on the substrate to yield a photoresist relief image.

In accordance with the discussion presented in connection with claim 1 above, the cited documents do not teach or suggest the method for forming a photoresist relief image recited in claim 13. As such, the method of claim 13 is separately patentable.

Claim 14 depends from claim 13, and provides a further limitation to the subject matter of claim 13. In particular, claim 14 recites the further limitation that the substrate is a microelectronic wafer or a flat panel display substrate. As such, claim 14 is separately patentable not only for the aforementioned reasons, but also further in view of the noted limitation.

Claim 15 recites an article of manufacture comprising a substrate having coated thereon a photoresist composition of claim 1. Claim 15 is separately patentable for the above-stated reasons and further because the cited documents fail to suggest any such article of manufacture.

Claim16 depends from claim 15, and provides a further limitation to the subject matter of claim 15. In particular, claim 15 add the further limitation that the substrate is a microelectronic wafer or a flat panel display substrate. As such, claim 16 is separately patentable not only for the aforementioned reasons, but also further in view of the noted limitation.

Independent claim 17 recites the following:

> Claim 17. A polymer that comprises 1) acid-labile groups; 2) meta-hydroxystyrene groups; and 3) para-hydroxyphenyl groups, wherein the meta-hydroxyphenyl groups each has a single meta-hydroxy moiety and is unsubstituted at other available ring positions.

In accordance with the discussion above, claim 17 is separately patentable in that the prior art documents, whether considered alone or in combination, simply fail to teach or suggest the photoresist composition of that claim.

Claim 18 is separately patentable for the above-stated reasons and further because the cited documents fail to teach or suggest the photoresist or polymer of claim 17 where the polymer has a structure represented by the specified Formula I. Clearly none of the cited documents suggest that recited formula. Dr. Pandya's Declaration also demonstrates significant performance results with such polymers.

Claim 19 depends from claim 18, and is separately patentable for the aforementioned reasons, and further in view of its respective additional limitations. For example, claim 19 limits substituent W to comprise an acrylate ester and also limits the sum of x, y and z to at least about 90 mole percent of total units of the polymer.

Claim 20 is separately patentable for the above-stated reasons and further because the cited documents fail to teach or suggest the photoresist of that claim where the polymer has a structure represented by the specified Formula IV. Clearly none of the cited documents suggest that recited formula. Dr. Pandya's Declaration also demonstrates significant performance results with polymers having a structure of Formula IV.

The patentability of dependent claim 21 is discussed above in connection with claim 6.

Claims 22 and 23 depend from claim 20, and each claim provides a further limitation to the subject matter of claim 20. In particular, claim 22 limits substituent R to a tert-butyl group, adamantyl, tetrahydropyranal, or norbornyl group. Claim 23 limits the sum of w, x, y and z to at least about 90 mole percent of total units of the polymer. As such, claims 22 and 23 are each separately patentable not only for the aforementioned reasons, but also further in view of the noted limitations.

Claim 25 is separately patentable for the above-stated reasons and further because the cited documents fail to teach or suggest the photoresist of that claim where the polymer has a

structure represented by the specified Formula II. Clearly none of the cited documents suggest that recited formula. Dr. Pandya's Declaration also demonstrates significant performance results with such polymers.

Claims 26 and 27 depend from claim 25, and each is separately patentable for the aforementioned reasons, and further in view of their respective additional limitations. For example, claim 26 limits substituent R to a tert-butyl group, adamantyl, tetrahydropyranal, or norbornyl group. Claim 27 limits the sum of w, x and y to at least about 90 mole percent of total units of the polymer.

Claim 28 is separately patentable for the above-stated reasons and further because the cited documents fail to teach or suggest the photoresist of that claim where the polymer has a structure represented by the specified Formula III. Clearly none of the cited documents suggest that recited formula.

Claim 29 depends from claim 28, and is separately patentable for the aforementioned reasons, and further in view of its respective additional limitation, e.g., wherein the sum of w', x', y' and z' is at least about 90 mole percent of total units of the polymer.

Claim 30 recites the following:

> Claim 30. A method for forming a photoresist relief image, comprising:
>
> a) applying a layer of a photoresist composition of claim 24 on a substrate; and
>
> b) exposing and developing the photoresist layer on the substrate to yield a photoresist relief image.

The cited documents do not teach or suggest the method for forming a photoresist relief image as recited in claim 30, or the method of claim 31, wherein the substrate is a microelectronic wafer or a flat panel display substrate. As such, claims 30 and 31 are each separately patentable

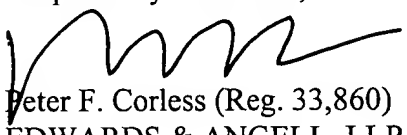
The cited documents do not teach or suggest a substrate having coated thereon a photoresist of the invention, as recited in claims 32 and 33. Thus, these claims also are separately patentable.

The cited documents also do not teach or suggest a polymer as recited in claim 34, which polymer comprises 1) acrylate acid labile groups; 2) meta-hydroxyphenyl groups; and 3) para-hydroxylphenyl groups. As such, that claim is also separately patentable.

SUMMARY

Therefore, for the foregoing reasons, it is respectfully requested that the Board reverse the final rejection in this application.

Respectfully submitted,



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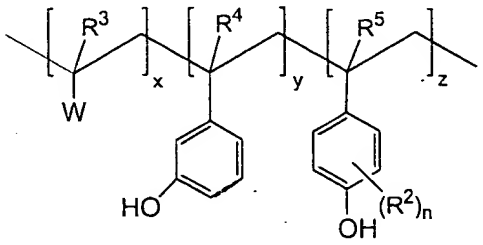
APPENDIX

1. A photoresist composition comprising a photoactive component and a resin that comprises a polymer that comprises 1) an acid-labile group; 2) a meta-hydroxyphenyl group; and 3) a para-hydroxyphenyl group, wherein the meta-hydroxyphenyl group has a single meta-hydroxy moiety and is unsubstituted at other available ring positions.

2. The photoresist of claim 1 wherein the polymer comprises pendant acrylate acid-labile groups.

3. The photoresist of claim 1 wherein the polymer comprises a structure of Formula I:



I

wherein W comprises an acid-labile group;

each R^2 is the same or different non-hydrogen substituent;

R^3, R^4 and R^5 are each independently hydrogen or optionally substituted alkyl;

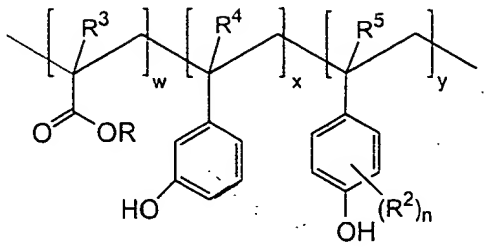
n is 0 to 4; and

x, y and z are each greater than 0 and are mole percents of the respective units of the polymer.

4. The photoresist of claim 3 wherein W comprises an acrylate ester.

5. The photoresist of claim 3 wherein the sum of x, y and z is at least about 90 mole percent of total units of the polymer.

6. The photoresist of claim 1 wherein the polymer comprises a structure of the following Formula II:



II

wherein R is optionally substituted alkyl;

each R^2 is the same or different non-hydrogen substituent;

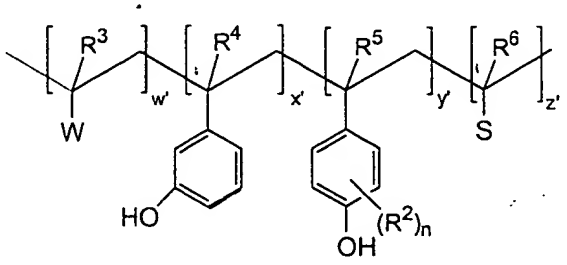
R^3, R^4 and R^5 are each independently hydrogen or optionally substituted alkyl;

n is 0 to 4; and

w, x and y are each greater than 0 and are the mole percents of the respective polymer units.

7. The photoresist of claim 6 wherein the sum of w, x and y is at least about 90 mole percent of total units of the polymer.

8. The photoresist of claim 1 wherein the polymer comprises a structure represented by the following Formula III:



III

wherein W comprises an acid-labile group;

each R^2 is the same or different non-hydrogen substituents;

R^3, R^4, R^5 and R^6 are each independently hydrogen or optionally substituted alkyl;

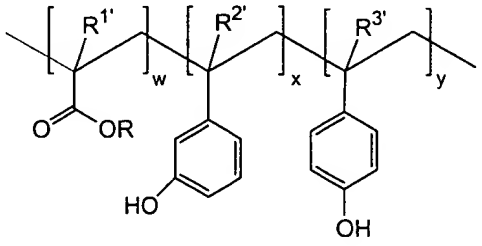
m and n are each independently 0 to 4; and

S is a group that does not contain acidic or reactive moieties;

w', x', y' and z' are each greater than 0 and are mole percents of the respective polymer units.

9. A photoresist of claim 8 wherein the sum of w', x', y' and z' is at least about 90 mole percent of total units of the polymer.

10. A photoresist of claim 1 wherein the polymer comprises a structure of the following Formula IV:



IV

wherein R is optionally substituted alkyl;

$R^{1'}$, $R^{2'}$ and $R^{3'}$ are each independently hydrogen or methyl;

w, x, and y are each greater than 0 and are mole percents of the respective units of the polymer.

11. A photoresist of claim 10 wherein R is tert-butyl group, adamantyl, tetrahydropyranal, or norbornyl.

12. A photoresist of claim 10 wherein the sum of w, x, and y is at least about 90 mole percent of total units of the polymer.

13. A method for forming a photoresist relief image, comprising:

a) applying a layer of a photoresist composition of claim 1 on a substrate; and

b) exposing and developing the photoresist layer on the substrate to yield a photoresist relief image.

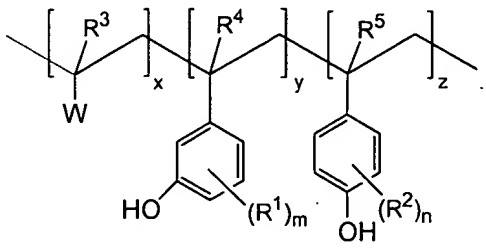
14. The method of claim 13 wherein the substrate is a microelectronic wafer or a flat panel display substrate.

15. An article of manufacture comprising a substrate having coated thereon a photoresist composition of claim 1.

16. An article of claim 15 wherein the substrate is a microelectronic wafer or a flat panel display substrate.

17. A polymer that comprises 1) acid labile groups; 2) meta-hydroxystyrene groups; and 3) a para-hydroxyphenyl group, wherein the meta-hydroxyphenyl groups each has a single meta-hydroxy moiety and is unsubstituted at other available ring positions.

18. A polymer of claim 17 wherein the polymer comprises a structure represented by the following Formula I:



I

wherein W comprises an acid-labile group;

each R^2 is the same or different non-hydrogen substituent;

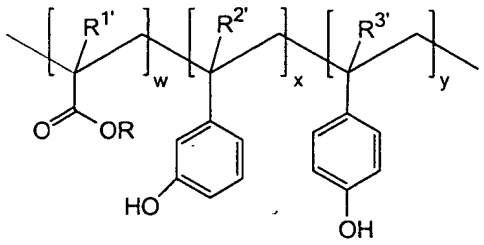
R^3, R^4 and R^5 are each independently hydrogen or optionally substituted alkyl;

n is 0 to 4; and

x, y and z are each greater than 0 and are mole percents of the respective units of the polymer.

19. A polymer of claim 18 wherein W comprises an acrylate ester, and the sum of x, y and z is at least about 90 mole percent of total units of the polymer.

20. A polymer of claim 18 wherein the polymer comprises a structure represented by the following Formula IV:



IV

wherein R is optionally substituted alkyl;

$R^{1'}$, $R^{2'}$ and $R^{3'}$ are each independently hydrogen or methyl;

w, x, and y are each greater than 0 and are mole percents of the respective units of the polymer.

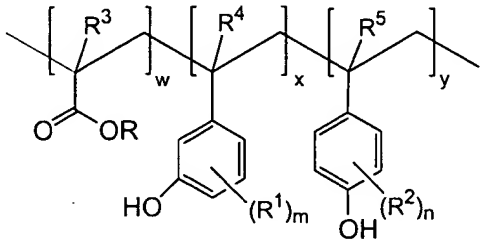
21. A photoresist of claim 6 wherein R is tert-butyl, adamantyl, tetrahydropyranyl or norbornyl.

22. A polymer of claim 20 wherein R is tert-butyl, adamantyl, tetrahydropyranyl or norbornyl.

23. A polymer of claim 20 wherein the sum of w, x, y and z is at least about 90 mole percent of total units of the polymer.

24. A photoresist composition comprising a photoactive component and a resin that comprises a polymer that comprises 1) an acrylate acid labile group; 2) a meta-hydroxyphenyl group; and 3) a para-hydroxyphenyl group.

25. The photoresist of claim 24 wherein the polymer is represented by the following Formula II:



II

wherein R is optionally substituted;

R^1 and R^2 are each the same or different non-hydrogen substituents;

R^3, R^4 and R^5 are each independently hydrogen or optionally substituted alkyl;

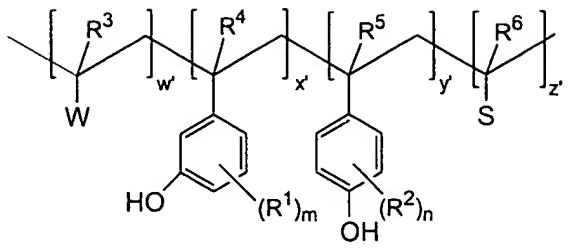
m and n are each independently 0 to 4; and

w, x and y are each greater than 0 and are the mole percents of the respective polymer units.

26. A photoresist of claim 25 wherein R is tert-butyl, adamantyl, tetrahydropyranyl or norbornyl.

27. The photoresist of claim 25 wherein the sum of w, x and y is at least about 90 percent of total units of the polymer.

28. The photoresist of claim 24 wherein the polymer is represented by the following Formula III:



III

wherein W comprises an acrylate acid-labile group;

R^1 and R^2 are each the same or different non-hydrogen substituents;

R^3, R^4, R^5 and R^6 are each independently hydrogen or optionally substituted alkyl;

m and n are each independently 0 to 4; and

S is a group that does not contain acidic or reactive moieties;

w', x', y' and z' are each greater than 0 and are mole percents of the respective polymer units.

29. A photoresist of claim 28 wherein the sum of w', x', y' and z' is at least about 90 percent of total units of the polymer.

30. A method for forming a photoresist relief image, comprising:

a) applying a layer of a photoresist composition of claim 24 on a substrate; and

b) exposing and developing the photoresist layer on the substrate to yield a photoresist relief image.

31. The method of claim 30 wherein the substrate is a microelectronic wafer of a flat panel display substrate.

32. An article of manufacture comprising a substrate having coated thereon a photoresist composition of claim 24.

33. An article of claim 32 wherein the substrate is a microelectronic wafer or a flat panel display substrate.

34. A polymer that comprises 1) acrylate acid labile groups; 2) meta-hydroxyphenyl groups; and 3) para-hydroxylphenyl groups.

Docket No. 50353

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT: A. Pandya et al.

SERIAL NO.: 09/228,694 EXAMINER: S. Lee

FILED: January 12, 1999 GROUP: 1752

FOR: HYDROXYPHENYL COPOLYMERS AND PHOTORESISTS COMPRISING SAME

THE HONORABLE COMMISSIONER OF PATENTS AND TRADEMARKS
WASHINGTON, DC 20231

SIR:

DECLARATION UNDER 37 CFR 1.132

1. I am an inventor on the above-identified application assigned to the Shipley Company and the IBM Corporation. I am employed by the Shipley Company and my current job title is Research Chemist A. I have worked in design and development of photoresist compositions since I commenced employment with the Shipley Company in 1992. I received my Ph.D. degree in Chemistry from Virginia Polytechnic University in 1992.

2. I had prepared the below-specified three copolymers (identified herein as Polymers 1, 2 and 3).

Polymer 1: consisted of 80 mole percent para-hydroxystyrene units and 20 mole percent of tert-butylacrylate units;

Polymer 2: consisted of 70 mole percent para-hydroxystyrene units, 10 mole percent meta-hydroxystyrene units and 20 mole percent tert-butylacrylate units;

Polymer 3: consisted of 50 mole percent para-hydroxystyrene units, 30 mole percent meta-hydroxystyrene units and 20 mole percent tert-butylacrylate units.

Each of Polymers 1, 2 and 3 had a weight average molecular weight of 10,000 daltons.

3. Each of Polymers 1, 2 and 3 were tested for dissolution rates in aqueous alkaline developer. Briefly, for each of Polymers 1, 2 and 3, an ethyl lactate solution of the polymer was spin coated onto a silicon wafer and solvent removed by heating the coated wafer at 130°C for about 60 seconds on a vacuum hotplate. The dried polymer layers were each about one micron in thickness. Dissolution rates of the polymer films were measured by immersion of the coated wafer in 0.26 N tetramethyl ammonium hydroxide aqueous solution and using a Perkin-Elmer 5900 Development Rate Monitor. The following dissolution rates were measured:

Polymer 1: provided a dissolution rate of 1164 angstroms per second;

Polymer 2: provided a dissolution rate 703 angstroms per second;

Polymer 3: provided a dissolution rate of 348 angstroms per second.

4. I further declare that all statements made herein of my own knowledge are true and that all statement made on information and belief are believed to be true; and further, that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, and that such willful false statements may jeopardize the validity of the any patent issued from the above-identified application.

Date: 4-25-2000

A Pandya

Ashish Pandya